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INVASION OF EXOTIC WEED *PARTHENIUM HYSTEROPHORUS* L. IN DISTRICT SHEIKHUPURA, PAKISTAN

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ABSTRACT

A survey of district Sheikhupura, Punjab, Pakistan was carried out during September-October 2006 after the rainy season, to study the distribution of an alien weed *Parthenium hysterophorus* L. in comparison with the native flora. Eleven sites, each of about 1 hectare area, were selected in different regions of the district. Sampling was done with the help of a 1 m^2 quadrate. Data regarding prevalence, frequency and density of *P. hysterophorus* and other weed species were recorded. *P. hysterophorus* was found to be present at all the 11 studied sites exhibiting 100% prevalence. *P. hysterophorus* exhibited an absolute frequency (AF) of 76% and relative frequency (RF) of 3.52. Only 8 out of 37 local weed species namely *Achyranthes aspera* L., *Amaranthus viridis* L., *Calotropis procera* Br., *Malvestrum tricuspidatum* A. Gray, *Cypreus rotundus* L., *Cenchrus biflorus* Roxb., *Cynodon dactylon* Pers. and *Dactyloctenium aegyptium* Beauv. showed higher AF and RF than this alien weed species. *P. hysterophorus* was found eighth most densely populated weed in the studied area exhibiting an absolute density of 3.37 and relative density of 4.45. An urgent integrated management strategy is the need of the hour to limit the rapid spread of this noxious alien weed in the area.

Key-words: Exotic weed, biological distribution, *Parthenium hysterophorus*, Sheikhupura (Pakistan)

INTRODUCTION

During the last century parthenium weed (*Parthenium hysterophorus* L.) has spread from its endemic habitat, mainly the region around the Gulf of Mexico including West Indies and presumably central Argentina (Picman and Towers, 1982; Adkins *et al*., 1996), throughout the tropics and has become a serious problem in many parts of the world. It accidentally introduced to neighboring country India in the 1956 through imported food grains. It is rapidly spreading in Pakistan for about last 20 years and is now a serious weed of wastelands and grazing lands, especially in rainfed districts of Central and Northern Punjab (Javaid and Anjum, 2005). It is considered a noxious weed because of its allelopathic effect (Swaminathan *et al.*, 1990; Singh *et al.*, 2002), its strong competitiveness for soil moisture and nutrients, and the hazard it poses to humans (Khosla and Sobti, 1981), and animals (More *et al.*, 1982). The chemical analysis has indicated that it contains parthenin, (Herz *et al*., 1962), coronopilin, tetraneurin A (Picman *et al.*, 1980), 2β-hydroxycoronopilin (Sethi *et al*., 1987) and hysterones A–D (Ramesh *et al.*, 2003). In addition to health hazards a lot of available data also highlights its impact on agriculture as well as natural ecosystems (Chippendale and Panetta, 1994, Batish *et al*., 2002; Singh *et al.*, 2002). The present survey was carried out to study the distribution of this noxious alien weed in district Sheikhupura, Punjab, Pakistan.

MATERIALS AND METHODS

Phytsociological study: Eleven waste and grazing lands were selected in different parts of district Sheikhupura. The distance between two sampling sites ranged from 3 – 8 km. At each of the eleven selected site, a 1 ha area was demarcated and sampling was done with a 1m^2 quadrate. Ten quadrates were randomly thrown at each sampling site. Prevalence, absolute and relative frequency, and absolute and relative density were calculated by applying the following formulae.

$$\text{Prevalence (\%)} = \frac{\text{No. of sites in which a species occurs}}{\text{Total No. of sites}} \text{ x } 100$$

$$\text{Absolute frequency (AF) (\%)} = \frac{\text{No. of quadrates in which a species occurs}}{\text{Total No. of quadrate}} \text{ x } 100$$

$$\text{Relative frequency (RF) (\%)} = \frac{\text{Absolute frequency value for a species}}{\text{Total absolute frequency values for all species}} \text{ x } 100$$

$$\text{Absolute density (AD)} = \frac{\text{Total No. of individuals of a species in all quadrats}}{\text{Total No. of quadrat}}$$

$$\text{Relative density (RD) (\%)} = \frac{\text{Absolute density for a species}}{\text{Total absolute density for all species}} \text{ x } 100$$

RESULTS AND DISCUSSION

A total of 38 weed species belonging to 13 families of angiosperms were identified from the 11 studied sites in district Sheikhupura. Maximum number of species i.e. 12 belonged to family Poacea, 5 to Asteraceae, 4 to Solanacea, 3 to Chenopodiceae, 2 to each of Malvaceae, Amaranthaceae and Euphorbiaceae, and one to each of Brassicaceae, Caesalpiniaceae, Convolvulaceae, Cyperaceae, Geraniaceae, Nyctaginaceae and Zygophyllaceae (Table 1).

Table 1. Frequency and density of *P. hysterophorus* and other weeds in wastelands at District Sheikhupura, Pakistan.

Species	Family	P	AF	RF	AD	RD
Parthenium hysterophorus L.	Asteracaeae	100	76	3.52	3.37	4.45
Ageratum conyzoides L.	″	100	45	2.08	1.04	1.37
Launea nudicaulis	″	91	54	2.50	0.92	1.21
Sonchus asper Vill.	″	100	54	2.50	0.92	1.21
Xanthium strumarium L.	″	73	39	1.80	0.75	0.99
Achyranthes aspera L.	Amaranthaceae	100	93	4.31	5.30	7.00
Amaranthus viridis L.	″	100	96	4.45	4.35	5.74
Calotropis procera Br.	Asclepiadaceae	100	81	3.75	2.49	3.28
Coronopus didymus (L.) Sm.	Brassicaceae	100	47	2.18	1.06	1.40
Cassia oscidentalis L.	Caesalpiniaceae	73	28	1.29	0.54	0.71
Chenopodium album L.	Chenopodicaeae	91	65	3.01	1.73	2.26
C. ambrosioides L.	″	91	48	2.22	1.05	1.38
Kochia indica Wight	″	100	44	2.04	1.10	1.45
Convolvulus arvensis L.	Convolvulaceae	82	45	2.08	1.02	1.34
Cypreus rotundus L.	Cyperaceae	100	93	4.31	5.21	6.88
Euphorbia pilulifera L.	Euphorbiaceae	64	26	1.20	0.50	0.66
E. prostrata L.	″	100	60	2.78	1.40	1.84
Malvestrum tricuspidatum A. Gray	Malvaceae	100	90	4.17	4.37	5.77
Malva parviflora L.	″	100	53	2.45	1.34	1.76
Oxalis corniculata Ait.	Geraniaceae	100	60	2.78	1.10	1.45
Boerhaavia diffusa L.	Nyctaginaceae	100	45	2.08	1.21	1.59
Brachiaria ramosa (L.) Stapf	Poaceae	82	45	2.08	1.40	1.84
Cenchrus biflorus Roxb.	″	100	97	4.50	5.89	7.77
Cynodon dactylon Pers.	″	100	90	4.17	3.59	4.74
Dactyloctenium aegyptium Beauv.	″	100	92	4.26	4.54	5.99
Dicanthium annulatum Stapf.	″	91	44	2.04	1.71	2.25
Digitaria timorensis (Kunth) Balansa	″	100	73	3.38	3.06	4.04
Eragrostis poaeoides Beauv.	″	100	60	2.78	1.96	2.58
Imperata cylindrical (L). Beauv.	″	91	56	2.55	3.05	4.02
Leptochloa chinensis Nees	″	45	12	0.55	0.22	0.29
Setaria glauca Beauv.	″	91	50	2.32	1.40	1.84
Sorghum helepense Pers.	″	91	52	2.41	1.46	1.92
Urochloa panicoides Beauv.	″	100	56	2.59	1.50	1.98
Datura alba Nees	Solanaceae	100	56	2.55	0.99	1.30
Solanum nigrum L.	″	91	45	2.08	0.94	1.24
Solanum xanthocarpum Schrad.	″	82	35	1.62	0.70	0.92
Withania somnifera Dunal.	″	100	61	2.83	1.06	1.40
Tribulus terrestris L.	Zygophyllaceae	100	56	2.59	1.68	2.21

P=Prevalence; **AF**=Absolute frequency;**RF**=Relative frequency; **AD**=Absolute density (m^{-2}); **RD**=Relative density

Prevalence

The alien weed parthenium was found to be present at all the 11 studied sites exhibiting 100% prevalence. Among the 37 local species, 15 species showed below 100% prevalence ranging from 45 – 91% (Table 1). The 100% prevalence of parthenium in the studied area could be attributed to high reproductive potential of this weed. parthenium weed is an extremely prolific seed producer, with up to 25,000 seeds per plant (Navie *et al*., 1996), and with an enormous seed bank, estimated at 200,000 seeds m^{-1} in abandoned fields (Joshi, 1991). Furthermore, seeds can germinate any time of year given suitable moisture levels. The seeds of *Parthenium* remain viable for a long time and can thrive under very harsh environmental conditions (Williams and Groves, 1980). Non dormancy and extreme light weight of its seeds armed with pappus are the characteristics which help its far and wide spread and establishment (Ramaswami, 1997).

Frequency

The frequency of various weeds ranged from 12 – 97%. Parthenium exhibited an absolute frequency (AF) of 76% and relative frequency (RF) of 3.52. Only 8 out of 37 local weed species namely *Achyranthes aspera, Amaranthus viridis, Calotropis procera, Malvestrum tricuspidatum, Cypreus rotundus, Cenchrus biflorus, Cynodon dactylon* and *Dactyloctenium aegyptium,* showed higher AF and RF than this alien weed species. A similar high frequency of parthenium has earlier been reported in other districts of the Punjab viz. Lahore, Sialkot and Okara (Anjum *et al.,* 2005, Javaid *et al.,* 2005; Javaid and Riaz, 2007).

Density

The absolute density (AD) and relative density (RD) of the various weed species ranged from 0.50 – 5.89 and 0.66 – 7.77%, respectively. Parthenium showed 3.37 AD and 4.45 RD that was higher than 30 local species. The 7 local species exhibited higher AD and RD than parthenium weed were *Achyranthes aspera, Amaranthus viridis, Malvestrum tricuspidatum, Cypreus rotundus, Cenchrus biflorus, Dactyloctenium aegyptium* and *Cynodon dactylon* (Table 1). Among these highly populated species only *A. aspera* and *M. tricuspidatum* have a plant body comparable to parthenium in size. Among rest of the species only *Xanthium strumarium, Calotropis procera, Cassia oscidentalis* and *Withania somnifera* has a size comparable to or greater than the parthenium. Most of the species found in the studied area have a markedly lower plant size than parthenium and thus exhibited lower coverage area than this weed. Because of very high prevalence, frequency, density and comparatively larger size than most of the species, parthenium can be ranked among the dominating wed species of the district Sheikhupura. Since Parthenium has the potential to produce large number of seeds per plant (Navie *et al*., 1996), precludes the neighboring species through allelopathic interactions (Singh *et al.,* 2002), germinate and grow throughout the year and above all lacks natural enemies in a region far away from its native home (Javaid *et al.,* 2007), it is feared that in near future it may emerge as a single dominating in waste and grazing lands of the area. An urgent integrated management strategy is, therefore, requires to limit the further spread of this weed in the area.

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